Space Weather Technical Forecast

Issued on Monday 18 November 2024 at 12:42 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: High Speed Stream solar winds bring a likelihood of enhanced geomagnetic activity at times.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate during the past 24 hours, with the highest M-class flare peaking at M2.5 at 18/1058 UTC, probably from newly numbered region AR3901, near the southeast limb.

There are currently eight sunspot regions on the visible disc, with two remaining unnumbered regions emerging from around the eastern limb. The largest sunspot region remains AR3889 in the far west, although this region continues to show simplification and a lack of activity. Newly numbered regions are emerging from the southeast limb and AR3901 looks to have some magnetic complexity, although still difficult to analyse due to the foreshortening affect. The other regions are simple and not magnetically complicated. No Earth-directed CMEs were observed over the past 24 hours in available imagery.

Solar Wind / Geomagnetic Activity: Solar winds at L1 measured by ACE were indicative of a slow-regime, with speeds between 320-360km/s. The solar wind density was below average. The interplanetary magnetic field (IMF), Bt, was weak 6-8nT. The north-south component also varying weakly, +6/-7nT. The phi angle was mostly positive (away from the Sun). The net result of the above solar wind measures was Quiet (0-2Kp) geomagnetic activity.

Energetic Particles / Solar Radiation: High energy proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was at Normal Background to Moderate levels, with a diurnal peak of 495pfu observed at 17/1430 UTC. The associated 24-hour fluence remained below the Active threshold, and the 24-hour integrated flux observed at 17/2359 UTC was 1.7e7.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate activity is expected, with the arriving regions contributing to a daily chance of M-class flares and a persistent slight chance of isolated X-class flares.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs currently feature in the forecast.

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The forecast is dominated by coronal hole fast winds. A slight enhancement is expected early in the period, with a likelihood of elevated wind speeds, 450km/s, occurring for a time during Day 1 (18 Nov) and into Day 2 (19 Nov). Solar winds may wane into Day 3 (20 Nov) but with the threat of further enhancement to slight elevated or elevated levels by Day 4 (21 Nov).

Quiet to Unsettled (Kp0-3) conditions expected through much of the period, with a chance of Active (Kp4) intervals through Days 1 and 2 (18-19 Nov). Activity expected to increase through Day 4 (21 Nov) becoming generally Unsettled to Active (Kp3-4) with a chance of G1 Minor Geomagnetic Storm intervals.

Energetic Particles / Solar Radiation: There is a daily Slight Chance of S1/Minor solar radiation storms mainly due to AR3889's position as it crosses the western limb.

Current Moderate to diurnally High energy electron flux at GEO may continue early in the period, before likely becoming suppressed by the onset of a faster solar wind from CH92/+. The associated fluence most likely remaining below the Active (1e8 integrated flux) threshold. 1.7e7 integrated flux was observed at 18/0001UTC.

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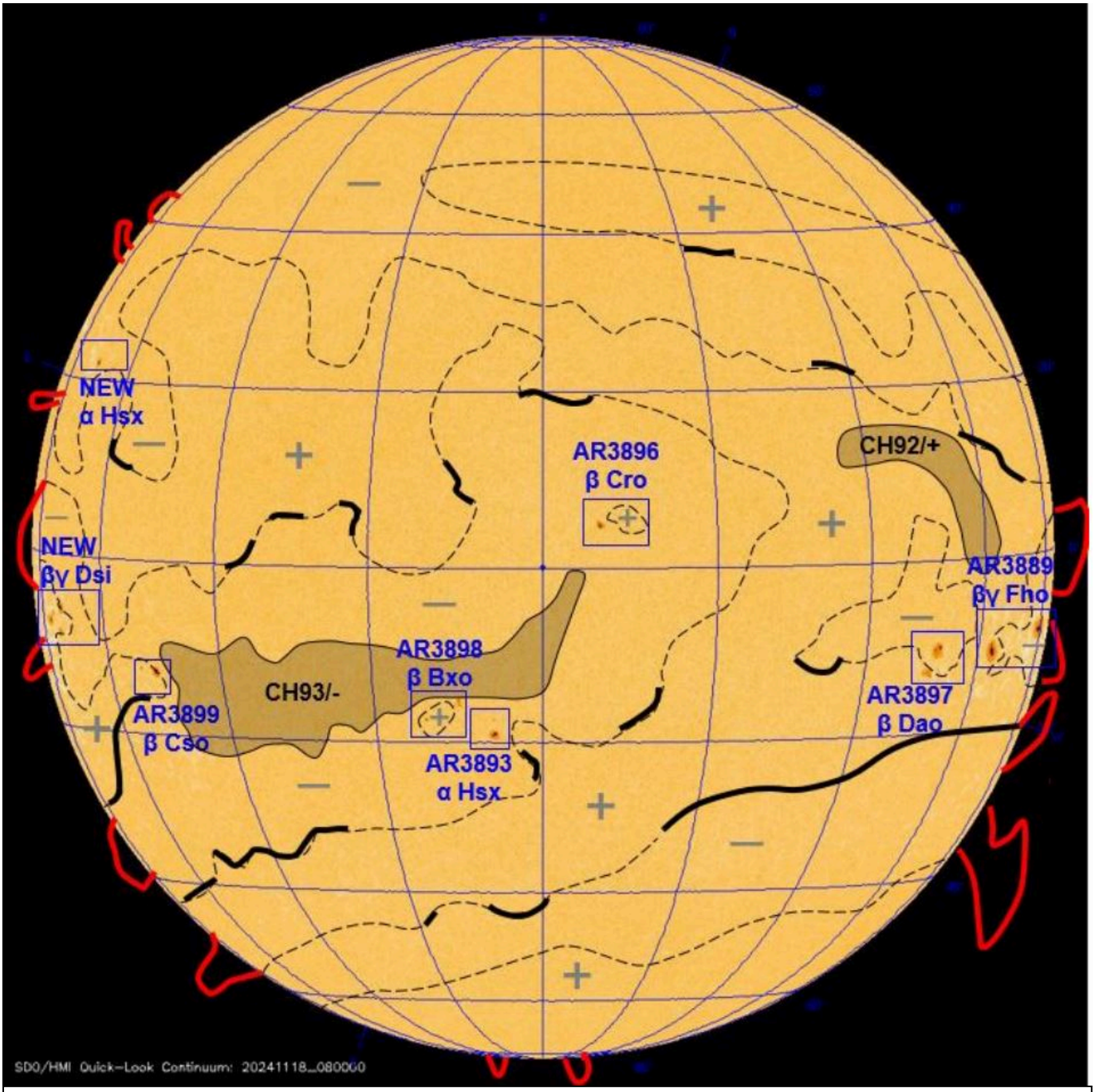
Figure 1: Solar Synoptic Map valid 18/0800 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

No CMEs feature in the forecast. However, there a very low possibility of a glancing CME blow, from a filament lift-off from the southwest quadrant, on the 15 Nov, this should pass ahead of Earth's orbit early on Day 1 (18 Nov) with no impacts currently expected from this feature.

The forecast is dominated by coronal hole fast winds, with two main source regions on the visible disk. An enhancement from CH92/+ in the west is probable early in the period, with a solar winds to around 450km/s, occurring for a time during Day 1 (18 Nov) and into Day 2 (19 Nov). Winds may wane into Day 3 (20 Nov) but with the threat of further enhancement to slight elevated or elevated levels by Day 4 (21 Nov) with the increasing risk of enhancement from the large CH93/- now approaching centre disk. An enhancement in solar winds to 550-600km/s is currently suggested by MOSWOC ENLIL output , although this viewed with caution, probably to high and too early to bring in any enhancement.

Quiet to Unsettled (Kp0-3) conditions expected through much of the period, with a chance of Active (Kp4) intervals through Days 1 and 2 (18-19 Nov). Activity probably increasing through Day 4 (21 Nov) becoming generally Unsettled to Active (Kp3-4) with a chance of G1 Minor Geomagnetic Storm intervals depending on the strength of any enhancement from CH93/- and any associated CIR region.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	10	10	1	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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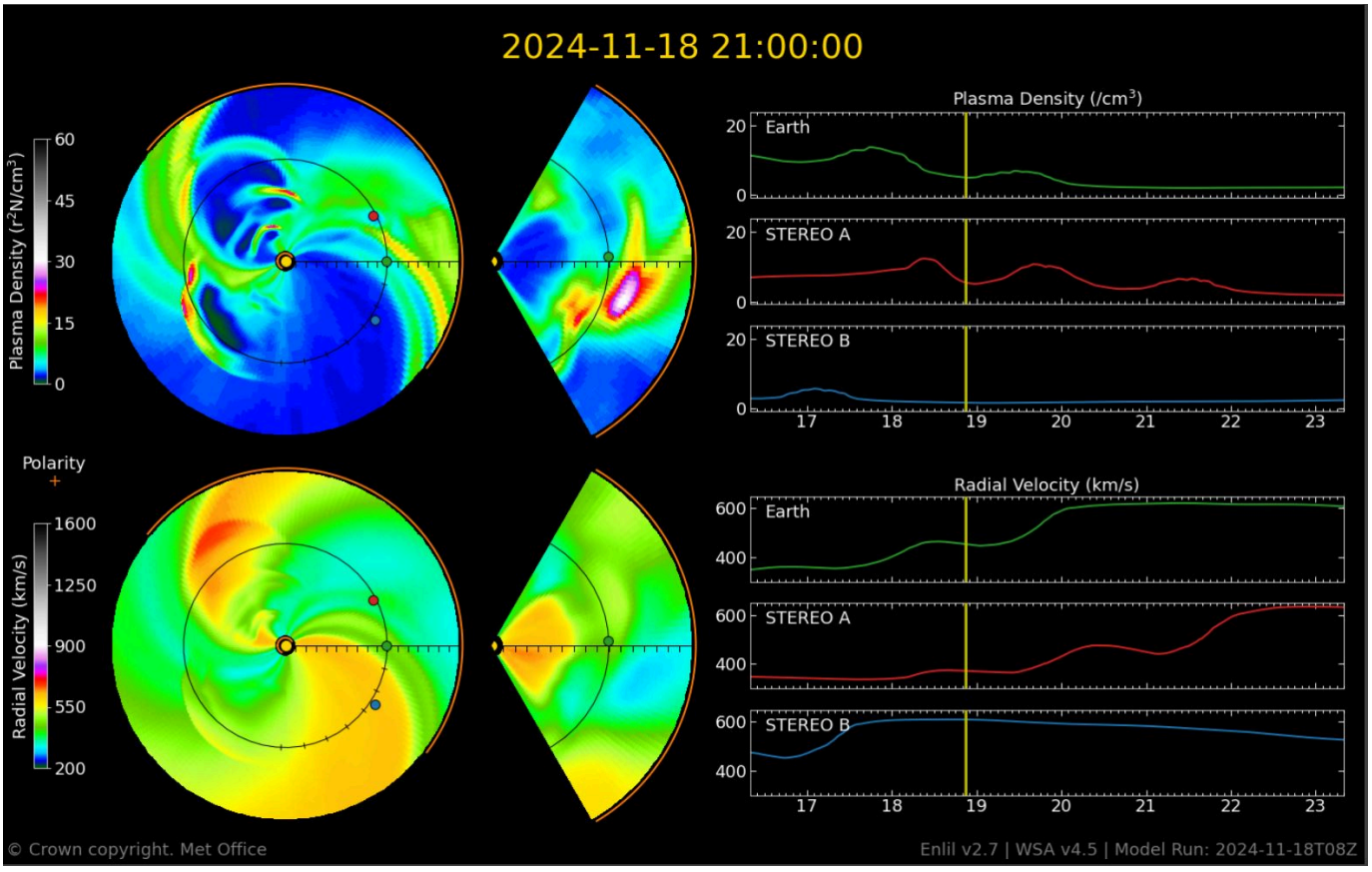
Figure 2: Latest ENLIL model output.



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Radio Blackouts - X-Ray Flares

Of the current front-sided sunspot groups, AR3889 in the southwest has historically carried the bulk of the current flare risk, but has steadily reduced given the recent simplification of the region, with oncoming regions in the southwest looking to increasingly represent the highest flare risk.

No particularly large far side regions are suggested by far-side sounding data, however recurrence suggest the position of a number of regions near the eastern limb and this minimises and reduces confidence in the signal from soundings. Recurrence, supported by brightening and magnetic looping on the eastern limb in SDO/AIA imagery and recent far-sided CMEs, continue to suggest the potential for sunspot regions to return to the visible disc over the period. Likely the first of which has emerged across the east limb, and remains rather difficult to analyse due to foreshortening.

Overall Low to Moderate activity is expected, with the arriving regions contributing to a daily chance of M-class flares and a persistent slight chance of isolated X-class flares, with the risk maintained steady through the period pending further developments. A chance of further Moderate activity and a continued slight chance of X-flares is maintained.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	Yes	30	30	30	40
Very Active	R3-R5 (X Class)	No	5	5	5	10

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Figure 3: X-ray flux plot at GEO with recent M-class flares in evidence.

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Solar Radiation Storms (High Energy Protons)

There is a slight chance of S1/Minor Solar Radiation storms over the period, chiefly due to any potential significant flaring from AR3889 as it approaches and rounds the western solar horizon. The series of inbound eastern limb regions are unlikely to present any appreciable risk to the daily probabilities of S1 in the near term.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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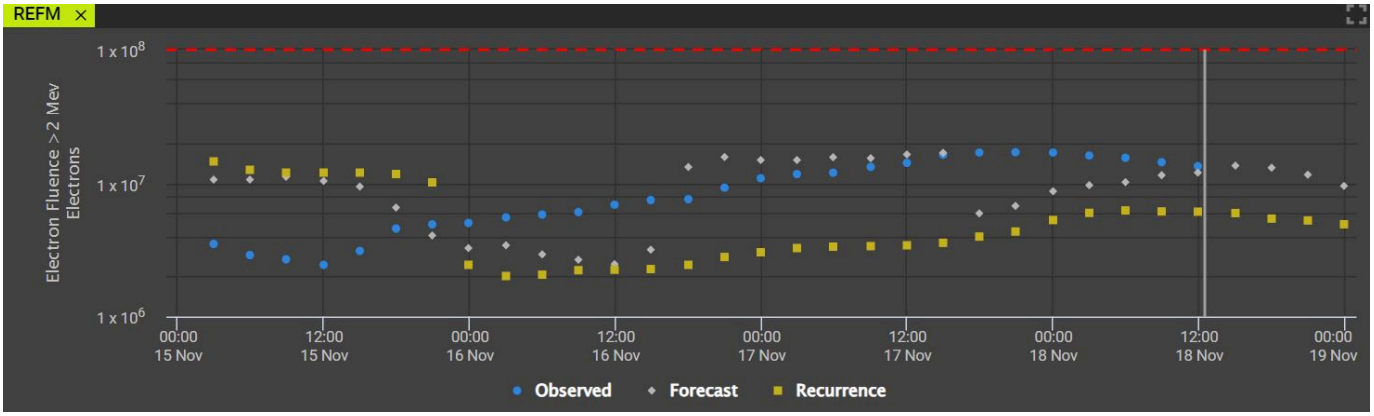
High Energy Electrons (≥ 2MeV)

Current Moderate levels of electron flux at GEO may continue early in the period, before perhaps becoming suppressed by the onset of a faster solar wind from CH92/+. The initial values unlikely to be of sufficient magnitude to trouble the Active 24-hour integrated threshold - no persistent feature on the disc has resulted in Active fluence. All considered, there is a slight chance of Active fluence. MOSWOC REFM output viewed as providing reasonable guidance at present.

GEO Electron Environment	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Active	≥ 2 MeV ≥ 1×10^{8}	No	1	1	5	10
Very Active	≥ 2 MeV ≥ 1×10^{9}	No	1	1	1	1

Figure 4: Latest Met Office REFM output



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